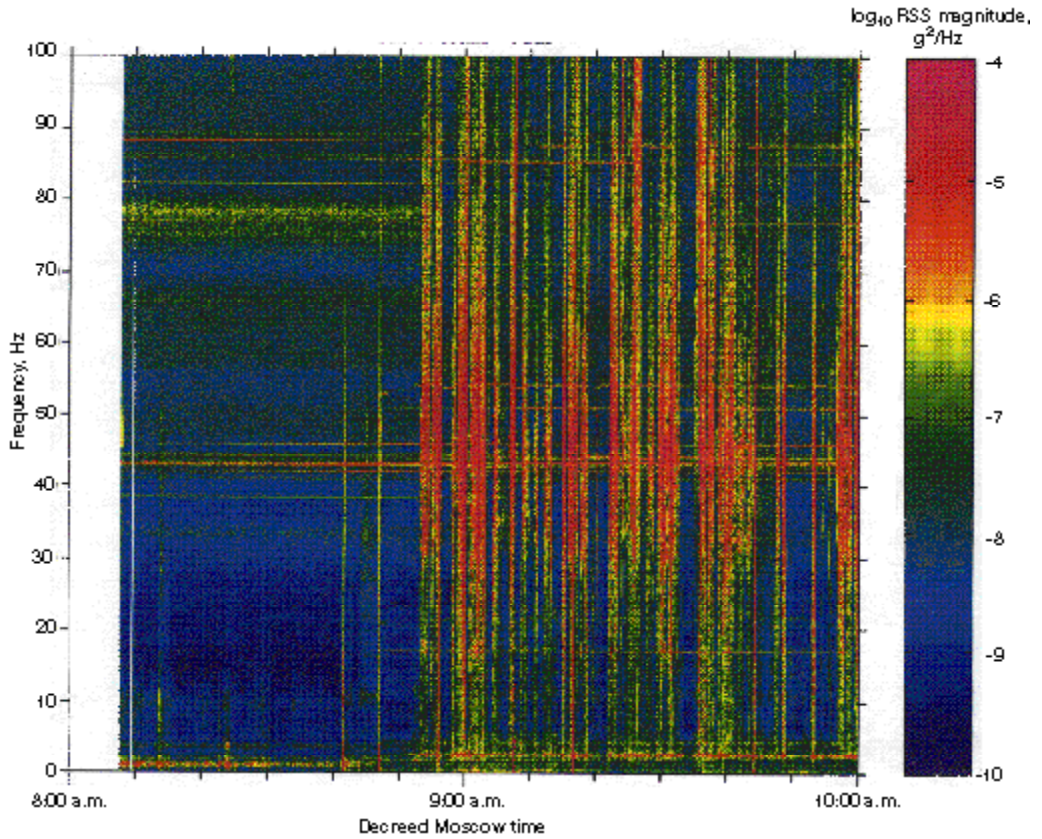
Measured Success--The Microgravity Measurement and Analysis Project

The microgravity environment created by an orbiting spacecraft allows people to float effortlessly and events to occur as if there were no gravity present. Microgravity is not the absence of gravity, but is a state where the effects of gravity have been greatly reduced. It makes possible experiments that are normally limited by gravitational effects on Earth. However, whereas gravity is greatly reduced during orbit, vibrations and motions of the shuttle can affect experiment results. For example, the shuttle vibrates, accelerates, and decelerates when thrusters are fired, experiments are operated, and the crew performs various operations and exercises, among many other things. In microgravity, even minute forces can affect experiments: therefore, investigators need to know the precise strength of the gravitational levels and vibrations affecting their experiments to interpret results correctly and to develop an understanding of the effects caused by these forces.

The Microgravity Measurement and Analysis Project (MMAP) at the NASA Lewis Research Center was established to provide a single source for measuring the microgravity environment on various orbiting spacecraft, providing support for scientists, and microgravity environment data. As part of this project, the Space Acceleration Measurement System (SAMS) and the Orbital Acceleration Research Experiment (OARE) have supported 15 shuttle missions. In addition, one SAMS unit has been operated on Russia's Mir Space Station since September 1994.



Spectrogram produced by the Principal Investigator Microgravity Services project with data from the Space Acceleration Measurement System (SAMS) on the Mir Space Station in late 1995. Docking of the Orbiter Atlantis (on the STS-74 mission) to Mir on November 15, 1995, is indicated by the sudden appearance of a vertical yellow line (17-Hz) at about 8:47 a.m. Before docking, activity on Mir was relatively quiet, whereas after the docking many events occurred, such as leak checks and hatches opening and closing. (Root sum of squares, RSS.)

SAMS and OARE data were prepared and distributed to users after each mission. Specialized analyses were performed by the Principal Investigator Microgravity Services project in real time during missions, as well as before and after the missions for principal investigators. Reports summarizing the microgravity environment of the mission were prepared by the Principal Investigator Microgravity Services project and distributed to users after each shuttle mission and periodically from Mir operations.

Future microgravity science research on the International Space Station will be supported by a project called SAMS-II that will measure the microgravity environment near each science experiment and deliver the data to the investigators at their operations center on the ground.

Other future microgravity science experiments that require an extremely low level of microgravity may fly on a free flyer (unmanned) carrier. SAMS-FF, another MMAP project under development, will measure and record the microgravity environment encountered on such a satellite during a typical 2-week mission.

For both International Space Station and free flyer operations, the Principal Investigator Microgravity Services project will continue to provide scientists with data interpretation and summary reports.

For more information, see our MMAP homepage.

Bibliography

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